METHOD FOR CONNECTING A FIRST USER-TERMINAL TO A SECOND USER-TERMINAL, RELATED DEVICES AND RELATED SOFTWARE MODULES

BACKground of the Invention

5   The present invention relates to a connecting method as described in the preamble of claim 1 and the related devices as described in the preamble of claims 6, 8, 10, 11, 12 and 13.

Such a method for connecting a first user-terminal to a second user-terminal is already known in the art, e.g. from the internet draft document *"A*
10   *FRAMEWORK FOR IP BASED VIRTUAL PRIVATE NETWORKS"* from the authors Bryan Gleeson et al, published in February 1999 by the Internet Engineering Task Force (IETF). Therein, a virtual private network is constituted by configuring all network access server access links, called stub-links in the referred draft, with the identity of the particular virtual private network whereto
15   the access link of the network access server belongs.

In this way each user-terminal is assigned to a particular virtual private network in a static way. Each of the user-terminals assigned to a common virtual private network are able to establish a communication with any other user-terminal assigned to the same virtual private network because
20   information on the address of each connected user-terminal, called reachability information is available within the virtual private network.

At the moment there is a first user-terminal being assigned to a first virtual private network willing to establish a communication with a second user-terminal being assigned to a second virtual private network there is no way of
25   connecting both user-terminals in order to establish a communication because there is no information available on the address of the second assigned to the second virtual private network.

An object of the present invention is to provide a method of the above known type, a system, a network access server, a subscriber data server
30   and a second user-terminal adapted to perform this method, but wherein access from a first user-terminal connected to a first virtual private network is

able to connect to a second user-terminal connected to a second virtual private network.

According to the invention, this object is achieved by the method described in claim 1, the network access server described in claim 6 and 8, the

5   subscriber data server described in claim 10 and 12 and the second user-terminal as described in claim 11 and 13.

Indeed, due to the fact that a subscriber data server is added to the network and that the necessary connection information is made available enabling to determine the location of the second, to be connected user-

10   terminal. This network element, the subscriber data server is able to store and retrieve information on which the network access server the second user-terminal is connected to and the virtual private network the meant user-terminal forms part of. At a connection request from a user-terminal forming part of a different virtual private network, the subscriber data server retrieves the

15   connection information about the second user-terminal in order to locate this user-terminal. Subsequently the subscriber data server forwards a connection request to the located second user-terminal. The second user-terminal in its turn decides on accepting the incoming call. If the incoming call is accepted, the user-terminal forwards a request to the network access server the user-terminal

20   is connected to, to switch its connection from the current virtual private network to the first virtual private network. At the moment the switch is performed, both user-terminals form part of the same virtual private network. Then they are able to establish a communication because address information of the second user-terminal is available and accessible for the first user-terminal in this context.

25   Another characteristic feature of the present invention is described in claims 2 and 7 and in claim 3.

Summary of the Invention

The connection request of the first user-terminal may be sent from the subscriber data server to the second user-terminal via the network access server where this network access server in a active way forwards the

30   connection request received from the subscriber data server to the second user-terminal. On the other hand the connection request may be passed, as

~~described in claim 3~~, over a transparent connection between the subscriber data server and the second user-terminal via the network access server. These are alternative solution for the transfer of the connection request between the subscriber data server and the second user-terminal.

Further characteristic features of the present invention are mentioned in claims 4, 8 and 9 and in claim 5.

The connection request of the first user-terminal may be sent from the first user-terminal to subscriber data server via the network access server where this network access server in a active way forwards the connection request received from first user-terminal to the subscriber data server. On the other hand the connection request may be passed, as described in claim 5, over a transparent connection between the first user-terminal and the subscriber data server via the network access server connected to the first user-terminal. These are alternative solution for the transfer of the connection request between the first user-terminal and the subscriber data server.

Brief Description of The Drawings

The above and other objects and features of the invention will become more apparent and the invention itself will be best understood by referring to the following description of an embodiment taken in conjunction with the accompanying drawings wherein:

FIG. 1 represents an internet network INW wherein the implementation of the present invention is realised;

FIG. 2 represents the network access sever NAS1 of FIG. 1;

FIG. 3 represents the subscriber data server SDS of FIG. 1;

FIG. 4 represents the second user-terminal UT2 of FIG. 1; and

FIG. 5 represents the network access server NAS2 of FIG. 1.

Detailed Description of the Invention

In the following paragraphs, referring to the drawings, an implementation of the method and the related devices according to the present invention will be described. In the first paragraph of this description the main elements of this network as presented in FIG. 1 are described. In the second paragraph, all connections between the before mentioned network elements and described means are defined. In the succeeding paragraph the actual

execution of the method for connecting a first user-terminal to a second user-terminal is described.

An essential element of this embodiment of the present invention is a network constituted by the internet network INW. Further there is a number of
5   user-terminals, but in order to keep simplicity in this description only two user-terminals UT1, UT2 are presented. Both user-terminals UT1 and UT2 are chosen to be a personal computer with a belonging screen and keyboard. Additionally there is a number of access nodes connecting each of the user-terminals to the internet network INW and taking care of subscription of the
10   connected user-terminals to a virtual private network. Concerning these access nodes, also because of reasons of simplicity only three access nodes NAS1, NAS2 and NAS3 are described and presented in FIG. 1. These access nodes NAS1, NAS2 and NAS3 are chosen to be network access servers.

User-terminal UT2 is connected to network access server NAS1 via
15   an Internet protocol link, further referred to as an IP-link. User-terminal UT1 is connected to network access server NAS2 via an IP-link. The network access servers NAS1, NAS2 and NAS3 each constitute the edge of the internet network INW and are all interconnected via the internet network. The subscriber data server SDS is connected to each of the network access servers
20   NAS1, NAS2 and NAS3 over an IP-link.

The network access node NAS1 as presented in FIG. 2. is built up of the switch notification reception means SNRM, that is able to receive a request from the second user-terminal UT2 to initiate a switch-over of the connection of the second user-terminal UT2 from a second virtual private network to a first
25   virtual private network, the switching means SM that is adapted to perform the switch of the connection of the second user-terminal from a second virtual private network to a first virtual private network and a user-terminal connect notification sending means HCNSM that is adapted to send registration information to the subscriber data server at connecting or changing of the
30   subscribed virtual private network of the second user-terminal to the respective network access server NAS1.

The switch notification reception means SNRM has an input-terminal that is at the same time also an input-terminal I_4 of network access server NAS1. The switch notification reception means SNRM further is coupled to the switching means SM which in its turn is coupled to the user-terminal connect

5   notification sending means HCNSM, that has an output-terminal which at the same time is an output-terminal O_0 of the network access server NAS1.

This network access server NAS1 optionally has the following means. At first there is a connection establishment request reception means CERRM1 that is adapted to receive a connection request from the subscriber

10   data server to establish a connection between the first user-terminal UT1 connected to a first virtual private network and the second user-terminal UT2 connected to a second virtual private network. Further there is a connection establishment request sending means CERSM1 that is able to notify the second user-terminal UT2 about an incoming call from the first user-terminal

15   UT1.

The connection establishment request reception means CERRM1 has an input-terminal that at the same time is an input-terminal I_2 of the network access server NAS1. The connection establishment request reception means CERRM1 in its turn is coupled to the connection establishment request sending

20   means CERSM2 that subsequently has an output-terminal that is at the same time an output-terminal O_2 of the network access server NAS1.

Besides these means the network access node NAS1 as presented in FIG. 2. may also comprise a connection establishment request reception means CERRM2, that is adapted to receive a connection request from the

25   second user-terminal to establish a connection between the second user-terminal connected to the second virtual private network and the first user-terminal connected to a first virtual private network and a belonging connection establishment request sending means CERSM3, that is adapted to notify the subscriber data server about an incoming call from the second user-terminal.

30   The connection establishment request reception means CERRM2 has an input-terminal that at the same time is an input-terminal I_4 of the network

access server NAS1. The connection establishment request reception means
CERRM2 in its turn is coupled to the connection establishment request sending
means CERSM3 that subsequently has an output-terminal that is at the same
time an output-terminal O_4 of the network access server NAS1. These latest

5 mentioned means optionally are to be included in a network access server and
excluding all other, previously mentioned means.

Network access server NAS2 and Network access server NAS3 have
the same structure as the Network access server NAS1 as previously
described.

10 The Subscriber Data Server SDS as presented in FIG. 3 is built-up of
the user-terminal connect notification reception means UTCNRM that is able to
receive the connection information sent at connecting of the second user-
terminal UT2 to network access server NAS1 or at switching a connection from
one virtual private network to another. The user-terminal connect notification

15 updating means UTCNUM is adapted to update the database DB of the
subscriber data server with the connection information. Further there is a
connection establishment request reception means CERRM that is able to
receive a connection request from the first user-terminal UT1 to establish a
connection between the first user-terminal connected to a first virtual private

20 network and the second user-terminal connected to a second virtual private
network. The registration information searching means RISM is adapted to
search in the database DB of the subscriber data server SDS for recent
registration information of the second user-terminal UT2, and the connection
establishment request sending means CERSM1, that is adapted to notify the

25 second user-terminal about an incoming call from a first user-terminal.

The user-terminal connect notification reception means UTCNRM
has an input-terminal that is at the same time an input-terminal I_0 of the
subscriber data server SDS. This user-terminal connect notification updating
means UTCNRM is coupled to the user-terminal connect notification updating

30 means UTCNUM which also has an output-terminal that is at the same time is
an input/output-terminal I/O_1 of the subscriber data server SDS.

The connection establishment request reception means CERRM has an input-terminal that is at the same time an input-terminal I_1 of the subscriber data server SDS and is coupled to the registration information searching means RISM. This registration information searching means RISM, has an input-

5   terminal that at the same time is an input/output-terminal I/O_1 of the subscriber data server SDS and further is coupled to the connection establishment request sending means CERSM1. The connection establishment request sending means CERSM1 has an output-terminal that is at the same time an output-terminal O_1 of the subscriber data server SDS.

10   The second user-terminal UT2 as presented in FIG. 4 is built-up of the connection establishment request reception means CERRM3, which is able to receive a connection request from the subscriber data server SDS to establish a connection between the first and the second user-terminal, and an incoming call handling means ICHM that is adapted to handle the connection

15   request from the first user-terminal. At last there is a switch requesting means SRM that is adapted to request the respective network access server to switch the connection of the second user-terminal UT2 from the second virtual private network to the first virtual private network.

The connection establishment request reception means CERRM3 has an input-

20   terminal that is at the same time an input-terminal I_3 of this second user-terminal UT2. Further, the connection establishment request reception means CERRM3 is coupled to the incoming call handling means ICHM, that in its turn is coupled to the switch requesting means SRM. The switch requesting means SRM has an output-terminal that is coupled to an output-terminal O_3 of the

25   second user-terminal UT2.

The network access server NAS2 as presented in FIG. 5 may alternatively being built up of a connection establishment request reception means CERRM4 that is adapted to receive a connection request from the first user-terminal UT1 to establish a connection between the first user-terminal UT1

30   that is connected to the first virtual private network and the second user-terminal UT2 that is connected to the second virtual private network and further

a connection establishment request sending means CERSM4 that is adapted to notify the subscriber data server SDS about an incoming call from the first user-terminal UT1.

The connection establishment request reception means CERRM4

5   has an input-terminal that at the same time is an input-terminal I_5 of the network access server NAS2. The connection establishment request reception means CERRM4 in its turn is coupled to the connection establishment request sending means CERSM4 that subsequently has an output-terminal that is at the same time an output-terminal O_5 of the network access server NAS2.

10   In order to explain the actual operation of the present invention it is assumed that a second user-terminal UT2 is connected to network access server NAS1 and is connected to a second virtual private network. It is further assumed that another user-terminal, a first user-terminal UT1 connected to network access server NAS2 and forms part of a first virtual private network

15   tries to contact the second user-terminal UT2.

According procedures that are well known in the art by the persons skilled in the art and therefor not described, the first user-terminal UT1 tries to obtain the Internet address, further referred to as the IP-address, of the to be contacted second user-terminal UT2.

20   Because both user-terminals are not connected to the same virtual private network it is not possible to connect both user-terminals. The first user-terminal will request the subscriber data server SDS for a connection to this second user-terminal by sending the connection request over a transparent connection between the first user-terminal and the subscriber data server via

25   the network access server NAS2.

Alternatively the connection request can be sent to a connection establishment request reception means of network access sever NAS2 that receives this connection request from the first user-terminal to establish a connection between the first user-terminal connected to a first virtual private

30   network and the second user-terminal connected to the second virtual private network. Subsequently the connection establishment request sending means of

network access sever NAS2 notifies the subscriber data server about an incoming call from the first user-terminal.

This may also be performed by the connection establishment request reception means CERRM4 of NAS2 that receives this connection request from the first user-terminal UT1 to establish a connection between the first user-terminal connected to a first virtual private network and the second user-terminal connected to the second virtual private network. Subsequently the connection establishment request sending means CERSM4 notifies the subscriber data server about an incoming call from the first user-terminal.

The connection establishment request reception means CERRM of the subscriber data server SDS receives this connection request from the first user-terminal. Subsequently the registration information searching means RISM starts searching in the belonging database DB of the subscriber data server SDS for connection information of this second user-terminal UT2.

The user-terminal connect notification sending means HCNSM sends connection information to the user-terminal connect notification reception means UTCNRM of the subscriber data server SDS at connecting of the second user-terminal to the respective network access server NAS1 or at switch-over to another virtual private network. The user-terminal connect notification reception means UTCNRM of the subscriber data server SDS receives this registration and forwards it to the user-terminal connect notification updating means UTCNUM that updates the database DB of the subscriber data server SDS with the recently received connection information. This registration information contains information to which network access server a user-terminal is connected and which virtual private network that user-terminal forms part of. There is also a list maintained for each user on which virtual private network the user has a subscription on.

The connection information searching means RISM then retrieves the connection information of the second user-terminal UT2. This connection information contains the information that the user of second user-terminal UT2 amongst others has also a subscription to the first virtual private network and

that this second user-terminal UT2 is connected to network access server
NAS1 and that it currently is connected to the second virtual private network.
Using this information, the connection establishment request sending means
CERSM1 will notify the second user-terminal UT2 about an incoming call from
5   the first user-terminal UT1 via a transparent connection between the subscriber
data server SDS and the second user-terminal UT2 via network access server
NAS1.

The notification of the second user-terminal UT2 about an incoming
call from the first user-terminal UT1 may alternatively be done by sending the
10   incoming call notification to the connection establishment request reception
means CERRM1 that receives a connection request from the subscriber data
server to establish the connection between the first user-terminal connected to
the first virtual private network and the second user-terminal connected to the
second virtual private network via the network access server. Subsequently the
15   connection establishment request sending means CERSM2 notifies the second
user-terminal about an incoming call from the first user-terminal.

The connection establishment request reception means CERRM3 of
the second user-terminal receives the connection request sent by subscriber
data server SDS and subsequently forwards this notification to the incoming call
20   handling means ICHM that handles this connection request from the first user-
terminal by, assume a pop-up screen requesting the user of the second user-
terminal UT2 to accept an incoming call from this first user-terminal and
postpone or finish the ongoing communication. If the user decides to accept the
incoming call from the first user-terminal the current communication is finished
25   and the switch requesting means SRM, of the second user-terminal requests
the network access server NAS1 to switch the connection of the second user-
terminal from the second virtual private network to the first virtual private
network. The switch notification reception means SNRM, receives the request
from the second user-terminal to initiate a switch-over of the connection of the
30   second user-terminal from the second virtual private network to the first virtual
private network and forwards it to the switching means SM that finally performs

the switch. At that time both the second and the first user-terminal form part of the same private network.

This means that the communication between the first user-terminal and the second user-terminal further can be established according to the previously mentioned procedures that are well known by persons skilled in the art.

The user-terminal connect notification sending means HCNSM further sends the updated registration information to the subscriber data server at connecting of said second user-terminal to the first virtual private network.

It is further to be remarked that any other communications network could have been described in this embodiment.

Another further remark is that the network as described in the previous embodiment may act as a sub-network of large network consisting of a number of these networks. In this way the network consists of a number of distributed subscriber data servers co-operating in order to perform the method as described for any of the sub-networks.

Although the above embodiment of the invention has been described by means of functional blocks, their detailed realisation based on this functional description should be obvious for a person skilled in the art and is therefore not described.

While the principles of the invention have been described above in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention, as defined in the appended claims.